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RESECTOSCOPE PROVIDED WITH A REMOVABLE EXTERNAL SHAFT

The present invention relates to a resectoscope of the kind defined in the preamble of claim 1.

For decades already resectoscopes of this species have been the backbone of urological instrumentation. For permanent rinsing they comprise an inner and an outer shaft, rinsing fluid being fed from the inner shaft and then being evacuated through the annular space between said shafts. The outer shaft is detachable by means of an externally actuated connector element. The optics monitoring the surgery zone, and the implement operational therein, for instance the conventional high-frequency (hf) cutting loop, run through the inner shaft .

As regards known resectoscopes of the species known from US patents 5,807,240 and 5,486,155, the inner shaft also is detachable by means of an externally actuated connector element. For more specific terminology herein, the connector elements for the outer and inner shafts hereafter are called external connector element and inner connector element respectively. In the known resectoscopes of the said species, the inner connector element also is actuated externally and it directly engages the resectoscope main body, whereas the outer connector element engages the inner connector element. It is furthermore known to make the outer connector element rotatable relative to the entire remaining resectoscope, inclusive the inner shaft.

One of the main problems encountered in resectoscope is the available length of the shaft that can be inserted into the typically human body. Said

length should be as large as possible whereas the total resectoscope should be minimized because being traversed for instance by the optics which on optical grounds should be as short as possible. Accordingly designers in this field attempt foremost to maximize the shaft length while paring resectoscope length elsewhere: difficulties arise.

The known design of resectoscopes of said species comprising two externally actuated connector elements, inherently limits the available shaft length.

The objective of the present invention is to create a resectoscope of the above species of simple design offering greater available shaft length.

This problem is solved by the features of claim 1.

In the present invention, the outer connector element directly engages the resectoscope main body. On the other hand no external connector element is used to actuate the inner connector element and as a result -- contrary to the case of conventional design, the length of one externally driven connector element, namely a minimum of about 5 mm, may be saved and, keeping the total resectoscope length constant, the available outer shaft length may be increased. This feature is of substantial advantage to the surgeon. The outer connector element directly engages the resectoscope main body. In this manner, that is circumventing external action on parts of an inner connector element placed at the resectoscope periphery, the connection zone may be shorted. The inner shaft in this design is affixed within the outer connector element.

According to claim 2 of the present invention, the inner shaft may be affixed to the resectoscope main body, preferably in permanent manner. This very simple design entirely circumvents the known inner connector element.

However the features of claim 3 are advantageous. By providing an inner connector element to remove the inner shaft, conventional instrument cleansing can be improved. The inner connector element may exhibit a variety of designs, for instance being a screw connection, bayonet connection, snap-in connection with elastic tongues or the like. The inner connector element need not exert substantial retaining forces because during use the inner shaft is protected by the outer shaft against mechanical stresses.

The features of claim 4 are preferred. Illustratively the inner shaft may be of constant cross-sectional shape and smooth as far as its proximal end by which it may be inserted into a resectoscope main body borehole where it might be permanently soldered or welded into place. Said inner shaft also may be connected by means of a thread or a bayonet lock to said borehole, or it may be merely plugged into this borehole and remain therein in frictional or press-fitted manner. Such a design is radially compact and consequently the enclosing outer connector also may be made compact and the entire assembly shall be slender.

The features of claim 5 are alternative and preferred. Thereby the inner shaft is affixed not to the resectoscope main body but to the outer shaft, namely to this outer shaft's proximal end zone. Illustratively said inner shaft may be inserted by its widened proximal end zone into the proximal end zone of the outer shaft and be soldered to it.

However the features of claim 6 are advantageous instead The inner shaft also may be detachably affixed to the outer shaft, similarly to the way it may be detachably fastened to a borehole in the resectoscope main body.

An alternative provides the preferred features of claim 7. Thereby the inner shaft is fitted with a connector element that, upon closure of the outer connector element, shall engage between the outer shaft and the resectoscope main body and in this way can be clamped into place when the outer connector element is closed. This feature offers a simple design variant where however the inner shaft can be removed only in the proximal direction from the outer shaft after the outer shaft has been detached from the main body – whereas, in other designs, the inner shaft may be removed in the distal direction from the outer shaft after loosening the inner connector element.

Independently of the design of the invention of the inner shaft affixation, the outer connector element may be conventionally rotatable. Even regarding the configuration of the feed and drain ducts at the outward hookup stubs, known designs may be used, including a rotatable outer connector element.

The invention is elucidated illustratively and schematically in the appended drawings.

Fig. 1 is a section of a first embodiment of a resectoscope of the invention, and

Figs. 2-4 show three further embodiments of details of Fig. 1.

The resectoscope 1 shown in Fig. 1 comprises a main body 2 to which an optics guide tube 4 is affixed inside a borehole 3, said tube 4 passing

proximally a distance from the main body 2 through an optics guide plate 5 within which it is affixed.

A carriage 6 with a thumb ring 7 runs on the optics guide tube 4 and is connected by means of a leaf spring 8 with the optics guide tube 5. As shown by Fig. 1, an optics 9 having an objective 10 can be inserted by means of the optics guide tube 4 in the distal direction far beyond the main body 2.

By holding the implement in one hand, the surgeon may actuate finger grips 11 at the main body 2 to displace the carriage 6 in the axial direction of the resectoscope 1 to move an elongated support 12 affixed to the carriage 6 at 13 through a duct 14 in the main body 2 far distally beyond said main body in order to reciprocate a surgical instrument (omitted in Fig. 1), for instance an hf-loaded cutting loop, which is mounted at the end of the support 12.

An inner shaft 15 enclosing the optics 9 and the support 12 is affixed to the main body 2. An outer shaft 16 enclosing the inner shaft 15 also is affixed to the main body 2. The shafts 15, 16 illustratively are cross-sectionally circular and configured mutually coaxially.

The tubular outer shaft 16 is affixed at its proximal end to an outer connector element 17 which, as shown, encloses the main body 2 and is detachably affixed by a locking pin 18 or some other means to said main body. This main body 2 supporting the outer connector element 17 comprises a borehole 19 within the outer surface 28 of this main body, said borehole 19 receiving the proximal terminal zone of the inner shaft 15. The inner shaft 15 is fitted in its proximal terminal zone and at one site of its circumference with a resilient lip 20 engaging in securing manner a matching radial clearance in the

borehole 19, as a result of which once inserted into the borehole 19, the inner shaft 15 is elastically secured though allowing being retracted again when the spring force is overcome.

The gap between the shafts 15, 16 may communicate with the outside through a radially configured borehole 21 passing through the outer connector element 17 and the outer shaft 16 firmly affixed to it. The inside space of the inner shaft 15 may communicate with the outside through a borehole 22 passing through the inner shaft 15, the main body 2 and the outer connector element 17.

In this embodiment, a hookup ring 23 is rests rotatably on the outer surface of the outer connection element 17 and is fitted with circumferential ducts 24 and 25 in the axial position of the boreholes 21 and 22, said ducts each communicating through valve-controlled hookup stubs 26, 27 to the outside in order to be connected as needed to evacuation or rinsing hoses.

In the shown embodiment, the outer shaft 16 jointly with the outer connector element 17 may be removed form the main body 2 following withdrawal of the locking pin 18. In the process the inner shaft 15 may remain at the main body 2 and then be pulled out of the borehole 19. This design furthermore allows seizing only the inner shaft 15 at the distal end and to remove it first through the outer shaft 16 still in place.

Figs. 2 through 4 show three alternative embodiments as a segment of the central region of Fig. 1. As far as feasible these Figs. 2-4 retain the design details of Fig. 1 and also their references.

Fig. 2 shows an embodiment wherein the inner shaft 15 is a smooth tube -- in particular devoid of the elastic lip 20 -- inserted into the borehole 19 of the main body 2. The inner shaft 15 may be affixed inside the borehole 19 for instance by soldering. In this embodiment, the inner shaft 15 therefore is rigidly affixed to the main body 2 whereas the outer shaft 16 is detachable as in Fig. 1 on account of the outer connector element 17.

However the outer shaft 15 may also be detachably connected to the main body 2 in the manner shown in Fig. 2. Illustratively the inner shaft 15 and the borehole 19 may be threaded, as a result of which the inner shaft 15 can be screwed into the main body 2.

Moreover the borehole 19 may be eliminated. In that case the inner shaft 15 may be affixed in another way to the distal end face of the main body 2 which then however must, at a minimum, allow the optics 9 and the support 12 to move into the inner shaft 15.

Fig. 3 shows another embodiment wherein the outer shaft 16 is affixed to the outer connector element 17 exactly as in the embodiment of Fig. 1 and can be connected by said element 17 to the main body 2 which is omitted from Fig. 3. In this embodiment of Fig. 3, the inner shaft 15 is widened in its terminal zone 15' to be the size of the inside diameter of the outer shaft 16 or of the outer connector element 17, and is inserted into same, as shown in Fig. 3. Said inner shaft 15 may be clamped in position in this configuration or illustratively it may be rigidly joined for instance by soldering to the outer shaft 16 respectively the main body 17.

The design of Fig. 3 also allows connecting the inner shaft 15 in detachable manner. Illustratively it may be fitted in its widened distal terminal zone 15' with an elastic lip 20 as shown in Fig. 1, said lip elastically engaging a corresponding clearance in the outer connector element 17. Bayonet and screw connections also are applicable at this site.

Another embodiment is shown in Fig. 4. The inner shaft 15 again is widened in its proximal terminal zone 15' but -- unlike the embodiment of Fig. 3 -- it comprises at its proximal end an outer flange 15" which engages between the outer connector element 17 and the main body 2 when these are affixed to each other and which, once the outer connector element 17 has been locked, this flange 15" shall be fixed in place. After the connection is dissolved and the outer connector element 17 is removed from the main body 2, the inner shaft 15 may be pulled out of the outer shaft 16 in the proximal direction.

The outer connector element 17 also may be designed in a manner other than shown in Figs. 1 through 4, for instance the rotatable hookup stub 23 may be omitted and the hookup stubs 26, 27 may be applied directly against the boreholes 21, 22. Moreover the outer connector element 17 may be supported in rotatable manner on the main body 2. In that case and keeping the locking pin 18, this pin might run in an outer groove of the main body 2. In this embodiment the annular ducts 24, 25 might run through the boreholes 21, 22 on the inside of the outer connector element 17.

If, in the above embodiment, the inner shaft 15 is permanently affixed to the main body, assembly will require inserting the implement support 12 from the distal side -- contrary to conventional assembly.